Atlas and Catalog of Collisional Ring Galaxies

Barry F. Madore

Observatories of the Carnegie Institution of Washington

813 Santa Barbara St., Pasadena, CA 91101

Erica Nelson

Observatories of the Carnegie Institution of Washington

813 Santa Barbara St., Pasadena, CA 91101

and

Pomona College

Claremont, CA 91711

and

Department of Astronomy

Yale University

J.W. Gibbs Laboratory

260 Whiteney Ave.

New Haven, CT 06511

Kristen Petrillo

Observatories of the Carnegie Institution of Washington

813 Santa Barbara St., Pasadena, CA 91101

and

Pomona College

Claremont, CA 91711

barry@ociw.edu, erica.nelson@pomona.edu, kristen.petrillo@pomona.edu

Received ______________; accepted ______________

Accepted: Astrophysical Journal Suppl., Feb. 2009

ABSTRACT

We present a catalog and imaging atlas of classical (collisional) `RING` galaxies distilled from the Arp-Madore *Atlas of Southern Peculiar Galaxies and Associations* and supplemented with other known `RING` galaxies from the published literature. The catalog lists the original host object, compiles available redshifts and presents newly determined positions for the central (target) galaxy and its nearest companion(s). 127 collisional `RING` systems are illustrated and their components identified. All of the `RINGS` have plausible colliders identified; many are radial-velocity confirmed companions. Finally, we make note of the existence of a rare sub-class of `RING` galaxies exemplified by AM 2136-492, double/concentric `RING` galaxies. These objects are predicted by numerical simulations, but they appear to be quite rare and/or short-lived in nature.

1. INTRODUCTION

Arp & Madore (1987, hereafter AM87) undertook a fairly comprehensive survey of the southern sky in search of peculiar and interacting galaxies visible on the IIIa-J photographic survey plates as part of the UK Schmidt sky survey. They inspected some 100,000 galaxies and culled out about 7,000 objects that were noteworthy enough to be cataloged, and in a number of cases, individually illustrated. Based on this statistically robust sample AM87 went beyond simple cataloging and added a broad list of descriptors covering about two dozen properties. One of these descriptor/classifications was Category 6: Ring Galaxy.

As already noted by AM87 “Ring Galaxy”, in the isolated context of this particular catalog, was a purely morphologically defined descriptor; as a consequence this descriptor encompasses several physically distinct types of galaxies. First, there are relatively normal

galaxies with "outer rings". In the RC3 system of de Vaulcouleurs et al. these are typed as **RS** galaxies, and called "outer ringed" galaxies in the compilation by Buta (1995). Outer rings are not uncommon and are generally well understood (see Buta for an overview). Second, there are "polar ring galaxies"; systems thought to be advanced mergers with the disrupted satellite now orbiting the parent galaxy over the pole and forming the ring-like structure. These are exceedingly rare objects (see Whitmore et al. 1990 for a recent compilation and references therein.) Finally, there are the collisional systems (called "`RING`" in RC3); and they are the focus of this paper.

In an earlier paper (which was based on an incomplete, early-release version of the Arp-Madore Catalogue) Few, Madore & Arp (1986) (hereafter FMA) pointed out the two dominant types of rings in the catalog and separated them into two distinct classes: **O-Types** for the outer ("resonant") rings, and **P-Types** for the classical ("collisional") rings. The main conclusion of that paper was that the **P-type** (`RING`) galaxies were consistent with the head-on collision scenario, being championed in that same time period by Theys & Spiegel (1976) and independently by Lynds & Toomre (1976). The full success of that theory has broader implications which are explored in Madore et al. (2009).

2. The Catalog

All three of the current authors independently inspected and reclassified each of the 500+ Category 6 (Ring Galaxies) in AM87. Only **P-type** galaxies (on the FMA classification system) were retained for this study. That is, any object with a crisp, relatively high-surface-brightness ring, with the nucleus often asymmetrically placed (or in some cases absent), was given the P classification and retained. Objects with more diffuse or feathery outer rings (of generally somewhat lower surface brightness), with fairly large nuclear regions or bulges symmetrically placed with respect to the ring, were deemed to

be the **O Types**. These objects were returned to the general pool. Out of 552 Class 6 (Ring) objects in AM87 we culled out 104 **P-Type** `RING` Galaxies; and for only a handful of objects was there any disagreement among the authors as to their classification. Erring on the conservative/inclusive side, all of the contentious objects were retained in this study.

Table 1 lists all 104 pure **P-Type** (`RING`) galaxies found in AM87. We note here that pure `RING` galaxies constitute less than 2% of the AM87 peculiar galaxy population, and as such they are found in the general population of galaxies only 0.01% of the time (as normalized by the entire population of ∼100,000 galaxies inspected by AM87 in the course of constructing the catalog as a whole.) `RING` galaxies are a rare type of collision with short-lived evidence. It is of course interesting to contemplate what `RING` galaxies look like after the collisionally-induced burst of star formation fades. We leave that as an exercise for the future.

Rather than simply illustrating a few of the most spectacular examples of `RING` galaxies, as was done in AM87, we have chosen to re-catalog and present the entire sample. However, before doing that we decided to additionally survey the literature for previously cataloged `RING` galaxies and add them to the *Atlas* for completeness sake. The AM87 sample is given in Table 1, while the `RING` galaxies from the literature are collected in Table 2. Clearly the northern and equatorial sky is incompletely sampled. We estimate that about 200 more `RING` galaxies await discovery once those regions are inspected to the same apparent-size and surface-brightness limit as AM87.

Table 1 and 2 share the same basic formating. Column 1 contains the name of the host `RING` galaxy complex; the second column contains the name or names of the ring nucleus followed by as many companions as are suspected of being colliders. The name of the ring nucleus is composed of the name of the host object followed by RN (e.g., AM 0147-350:RN); by way of contrast, companion/colliders are identified by the host object name followed by

C1, C2, etc. (e.g., AM 0147-350:C1, AM 0147-350:C2, AM 0147-350:C3). Columns 4 and 5 respectively contain RA(2000) and Dec(2000) positions, each measured to a precision of 5 arcsec. In Column 5 the first entry (D = diameter), corresponds to the diameter of the ring, measured in arcsec, while the following entries in that same column but now for the companions are marked by S, and give the separation of the companion from the nucleus of the ring (again, measured in arcsec). Finally, Column 6 gives the heliocentric velocity for the object/component when available from the literature as captured by NED in its December 2008 release.

3. The Ring Galaxy Sample

3.1. Some General Remarks and Demographics

All of the objects in this new listing consist of at least two objects in the immediate field of view that can reasonably be identified with the collider and the (collidee) ring. We mark those objects in each of the illustrations and for uniformity sake we have measured the positions of all objects given in Tables 1 and 2 using the display capabilities of ALADIN interacting with the NED image archive. The presence of nearby companions was by no means a foregone conclusion given that the `RINGS` were chosen purely on the basis of their morphology, not on the basis of their nearby or distant environment. We consider it highly likely that these optical companions are the colliders, plausibly responsible for the "gravitational splash" and the ensuing ring-like, star-formation response predicted/post-dicted by the simulations. Indeed, of the 64 companions with published redshifts (found from a search of the January 2008 release of the NED database) 60 have redshifts that place them at the same distance as the ring itself. In all four of the other instances where one of the apparent companions proved to be a background object there was always an additional candidate collider in the same field of view. Although common

radial velocities are not conclusive proof that any given object is the collider it does clearly demonstrate that the vast majority of those objects are not chance line-of-sight background (or foreground) objects. 111 apparent companions still need redshifts; 43 of the rings themselves are without published velocities. We are working to ameliorate that situation.

While all of our `RING` galaxies have one or more apparent companions, as a class `RING` galaxies tend not to be found in high-density (cluster) environments. Indeed, only 7 of the 132 `RINGS` cataloged here have more than three companions in their immediate vicinity. They are AM 0401-641, AM 0417-391, AM 0455-465, AM 1003-215, AM 1251-283, AM 2100-725 and AM 2200-715. 83 of the `RINGS` have only one nearby optical companion, 29 have two companions, and only 13 have three. It seems reasonable to suppose that in dense systems the more frequent, but off-center encounters with other group members will disrupt and/or destroy any ring that might form from a direct hit more quickly than in the quiescent field. Perhaps the increased velocity dispersion of all the members associated with the cluster environment also plays a role. And it should not be forgotten that very rich clusters are *currently* depleted of disk galaxies in any case: with no disks to be hit, no rings can be formed. However, at high redshift the situation is expected to be quite different. A search for `RINGS` in various "deep fields" (UDF, GOODS and GEMS) has been made (Elmegreen & Elmegreen 2006). According to those authors and judging from the published images of their pure "rings" (their Figure 1) these are almost exclusively **O-Type** (outer-ring) galaxies with well-centered bulges and no obvious companions. Some collisional objects may be found in their sample of fifteen "partial rings"; however, the area shown around each partial ring is too small to judge whether these objects have interacting companions or not.

Figure 1 shows the wide range of absolute (K-band) magnitudes that the `RING` galaxies in this catalog have. Spanning more than a factor of 100 in luminosity galaxies with

ring-like morphology can be as faint as M_K = -19 mag and as bright as M_K = -25 mag; typical `RING` galaxies have M_K = -23 mag which is somewhat fainter than the knee in the general-field luminosity function. The colliders are typically half a magnitude fainter than the central (target) galaxy (Figure 2), but their dispersion is large (±0.75 mag). The current diameters of the rings cataloged here span a wide range being broadly peaked at 30-40 kpc, but extending up to values as large as 70 kpc (Figure 3). None of these plots argue for separate populations of `RING` galaxies based solely on these physical properies.

3.2. Empty Rings

Some `RING` galaxies (e.g., AM 0058-220, AM 1953-260, Arp 147 & VII Zw 466) do not have any obvious component that can unambiguously be identified as a nucleus. The morphology of such objects has been aptly likened to "smoke rings." The apparent lack of a nucleus may be because the target galaxy simply never had a particularly noteworthy nucleus to begin with (i.e., even before the collision) or it may be that the timing of the interaction, combined with our particular viewing angle places the nucleus in the ring (see NGC 4774, Arp 146) and/or even confused with the intruder. In other instances the nucleus may have been disrupted by the collision. Detailed modeling would illuminate these possibilities.

3.3. Double Rings

We draw attention to a sub-class of objects in this compilation of `RING` galaxies: double rings. AM 2136-492 is noteworthy. The Cartwheel (AM 0035-335) is another example (with its celebrated compact nuclear ring); while AM 0339-625, AM 1323-222 and AM 1354-250 may be other less obvious examples of this class. Figure 6 shows a deeply stretched image

of AM 0339-625 illustrating its fragmented, outer ring-like feature. Although multiple rings structures seem to be a common feature in the numerical simulations (e.g. Antunes & Wallin 2007) they appears not to be not so common in nature.

4. Implications

A simple calculation concerning the apparent frequency of `RING` galaxies leads to a rather surprising/interesting result. The relative frequency of the collisonal ring phenomenon is at least 1 in 1000, given that AM87 inspected approximately 100,000 galaxies and out of those cataloged only 100 rings. (And this is a lower limit given that edge-on rings are probably under-represented in the catalog.) If the ring structure can unambiguously be detected as such for one dynamical timescale (10^8 yrs, say) and if the collision rate is constant over cosmic time, then about one in every ten galaxies in this same volume is expected to have been perturbed in this same way over a Hubble time. Given the restricted parameter space available for a head-on collision to occur this strongly suggests that, if the orbits of these types of companions are isotropic (and only a small fraction of them produce rings) then the majority of galaxies in the local volume have presumably been hit (with a different impact parameter) by a companion comparable in mass to that of a typical ring-galaxy collider.

In Figure 4 we show the histogram of relative velocities from those `RING` galaxies with redshift measurements for both the ring itself and at least one of its putative colliders. The median velocity difference for this sample is rather small ($\sim$100 km/s). Excluding obvious background objects with ΔV > 1,000 km/s, the largest two remaining velocity differences are 293 and 419 km/s. We conclude that the majority of these systems are bound and that if simulations are a guide then there will be a rapid merging of these pairs in the course of the next passage.

5. Discussion & Conclusions

Computer simulations of galaxy interactions first showed that RING galaxies could convinciungly be created by the head-on collision of a satellite galaxy with a primary disk. Observations of prototypical RING galaxies, such as the Cartwheel (Fosbury & Hawarden 1977) and the Lindsay-Shapley ring, each confirmed the "prediction" in as much as colliders were found in evidence, and within the range of distances, velocities and position angles expected for head-on collisional events. The present study follows the early work of Few, Madore & Arp (1986) and extends this confirmation of theory from a handful of galaxies to a relative complete sample of over 100 suspected and previously cataloged RING galaxies.

However, there is another prediction that is fundamentally at odds with what is observed for this sample of RING galaxies. That prediction comes from Λ-CDM cosmology in which many more satellite galaxies are expected to be orbiting central galaxies than are in fact observed. Making these satellites non-luminous (be it by supernova events, by interactions, by initial conditions, or by fiat) does not prevent them from interacting gravitationally, and as such they too should be responsible for creating rings through collisions in direct proportion to their numbers with respect to their luminous colliding counterparts. The astonishing fact is that *there is not a single compelling example of a* RING *galaxy without a plausible optical collider.* There is no isolated Cartwheel in the sky; there are no smoke rings without the smoking gun. And there should be many. We state this simple fact and leave a more detailed discussion of this point and its implications for Λ-CDM cosmology to the companion paper by Madore et al. (2009).

Acknowledgements

We wish to acknowledge and thank the creators of SAOImage DS9 and Aladin both of which were used extensively in the preparation of this *Atlas*. And, of course, this research has made use of the NASA/IPAC Extragalactic Database (NED) which is operated by

the Jet Propulsion Laboratory, California Institute of Technology, under contract with the National Aeronautics and Space Administration. Finally, we thank Ian Steer for bringing the ring galaxy IC 1908 to our attention.

References

Antunes, A. & Wallin, J. 2007, ApJ, 670, 261

Arp, H.C. 1966, ApJS, 14, 1

Arp, H.C. & Madore, B.F. 1987 *Catalogue of Southern Peculiar Galaxies and Associations*, Cambridge University Press, Cambridge.

Buta, R. 1995, ApJS, 96, 39

Buta, R. & Combes, F. 1996, Fund. Cosmic Physics, 17, 9

Elmegreen, D.M. & Elmegreen, B.G. 2006, ApJ, 651, 676

Few, J.M.A., Arp, H.C. & Madore, B.F. 1982, MNRAS, 199, 633

Few, J.M.A., Madore, B.F. & Arp, H.C., 1986, MNRAS, 222, 673

Fosbury, R.A.E. & Hawarden, T.G. 1977, MNRAS, 178, 473

Lynds, C.R. & Toomre, A. 1976, ApJ, 209, 382

Madore, B.F., Nelson, E. & Petrillo, K. 2009, ApJ, (submitted)

Marston, A.P. & Appleton, P.N. 1995, AJ, 109, 1002

Whitmore, B.C., Lucas, R., McElroy, D.B., Steinman-Cameron, T., Sackett, P.D. & Oiling, R.P. 1990, AJ, 100, 1489

Theys, J.C. & Spiegel, E.A. 1976, ApJ, 208, 650

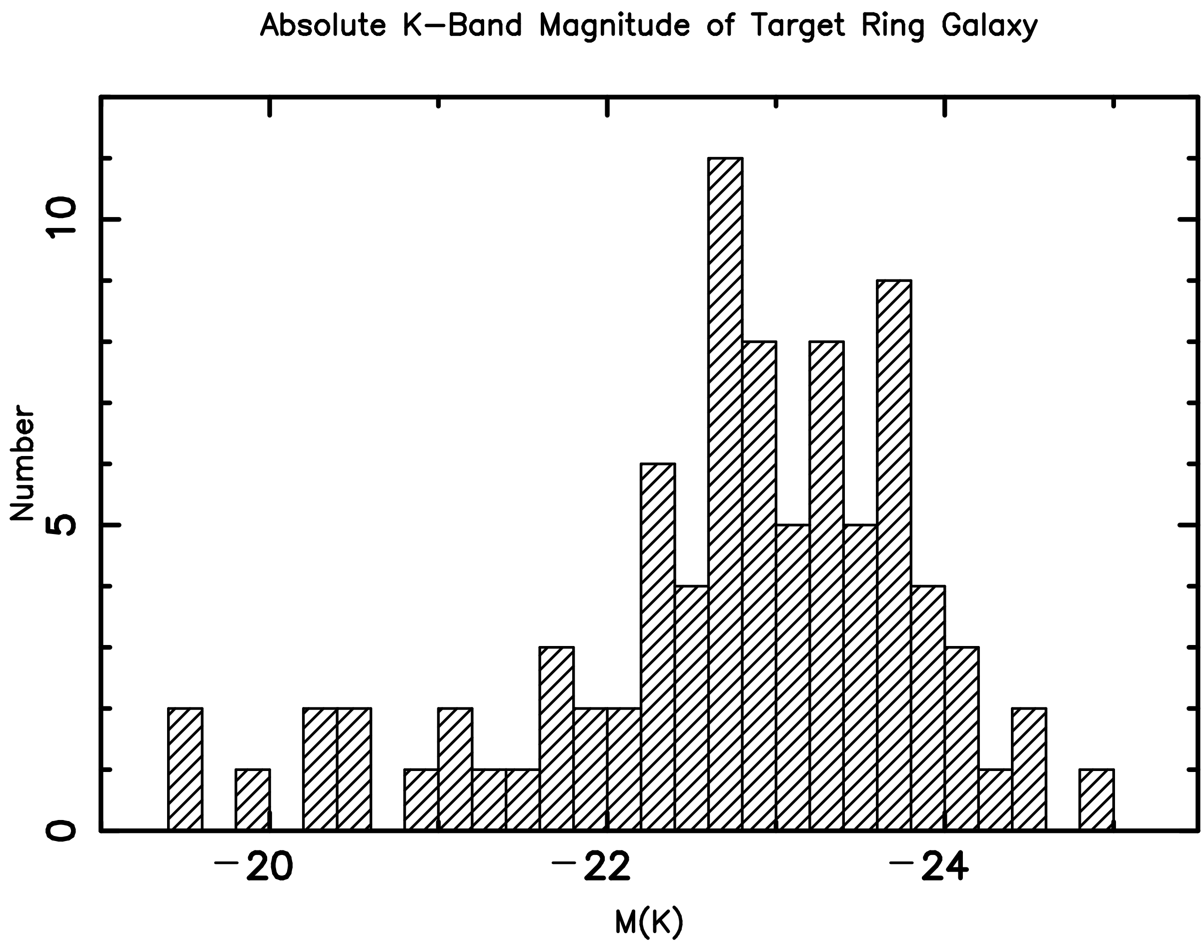


Fig. 1.— Histogram of the absolute K-band magnitudes of the central (RING) galaxy.

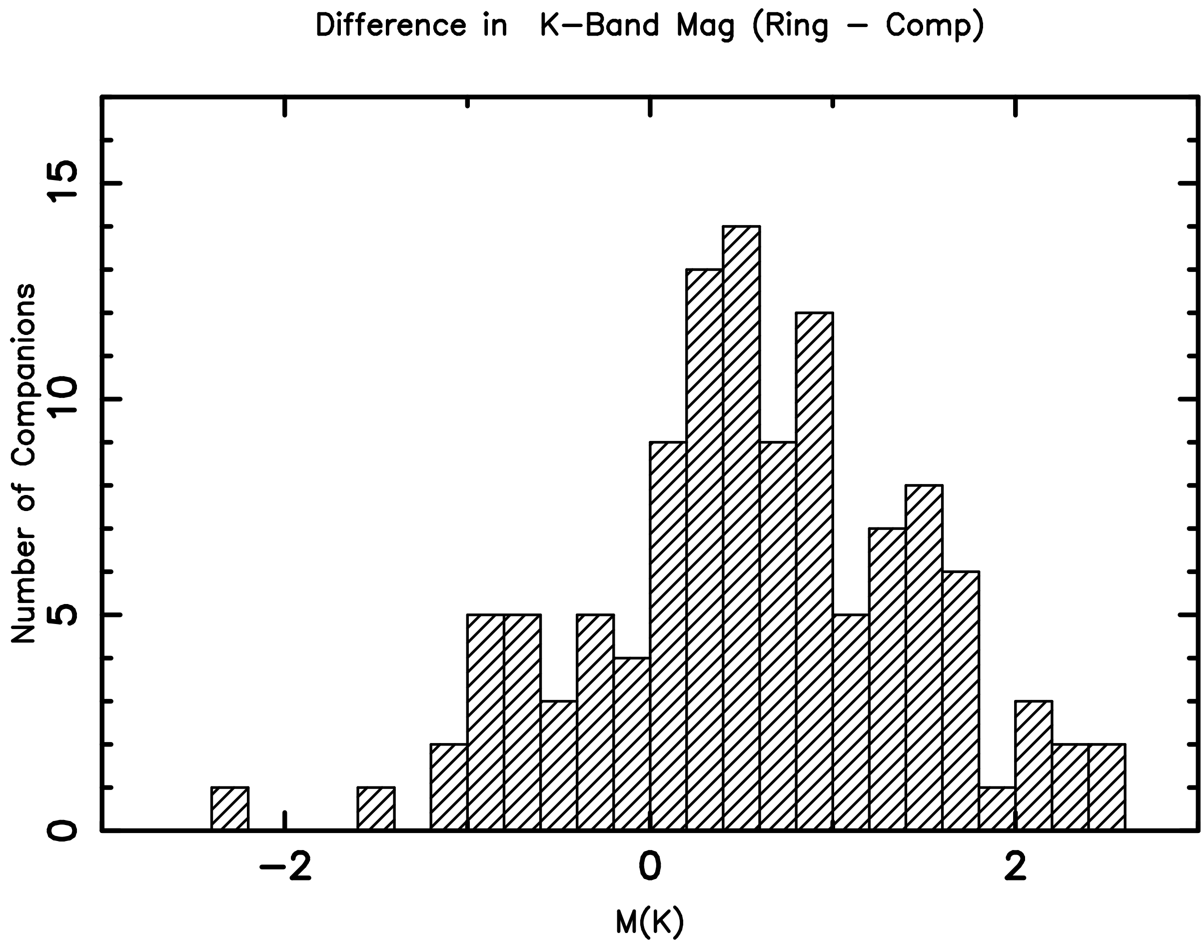


Fig. 2.— Histogram of the K-band magnitude differences between the central RING and its collider.

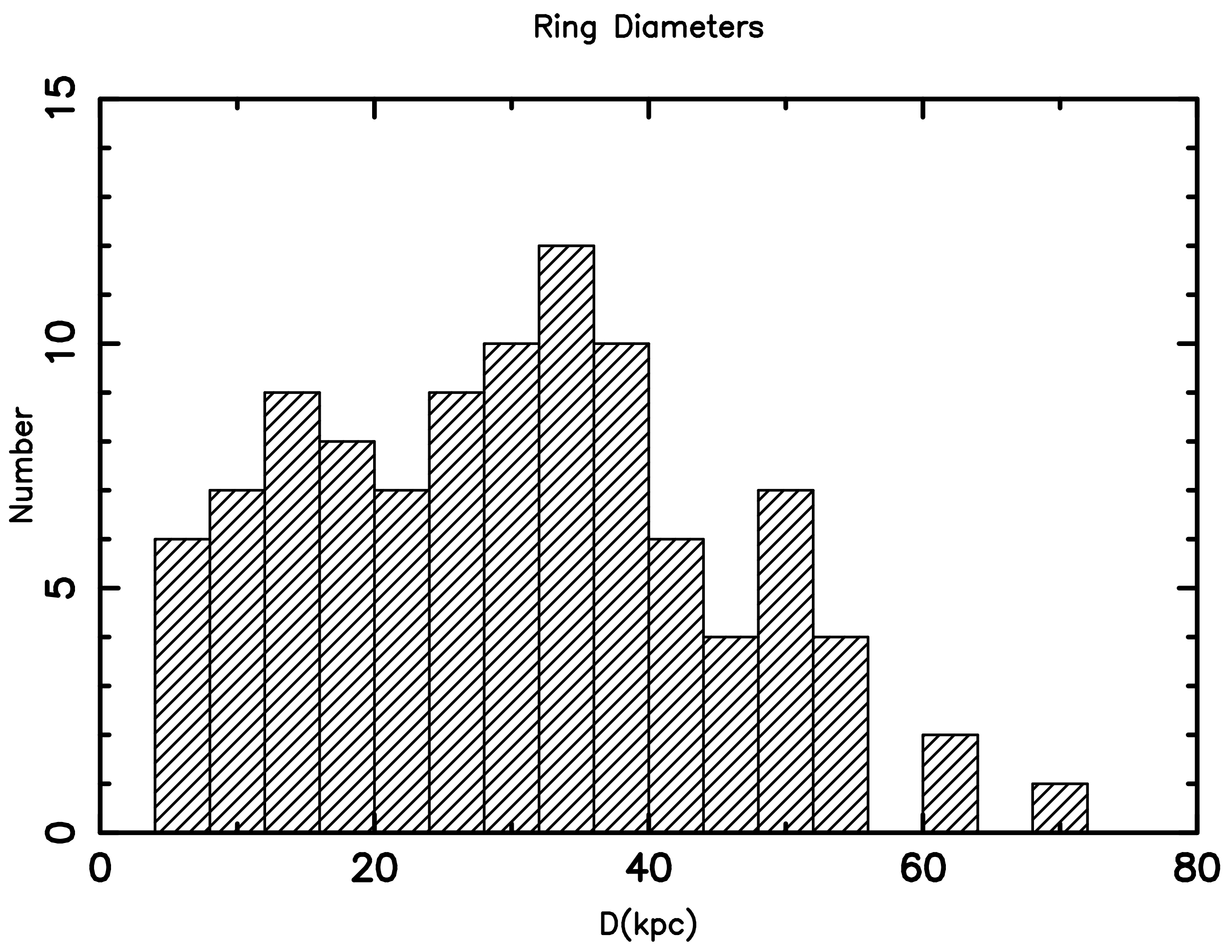


Fig. 3.— Histogram of the metric major-axis diameters of the rings in units of kpc.

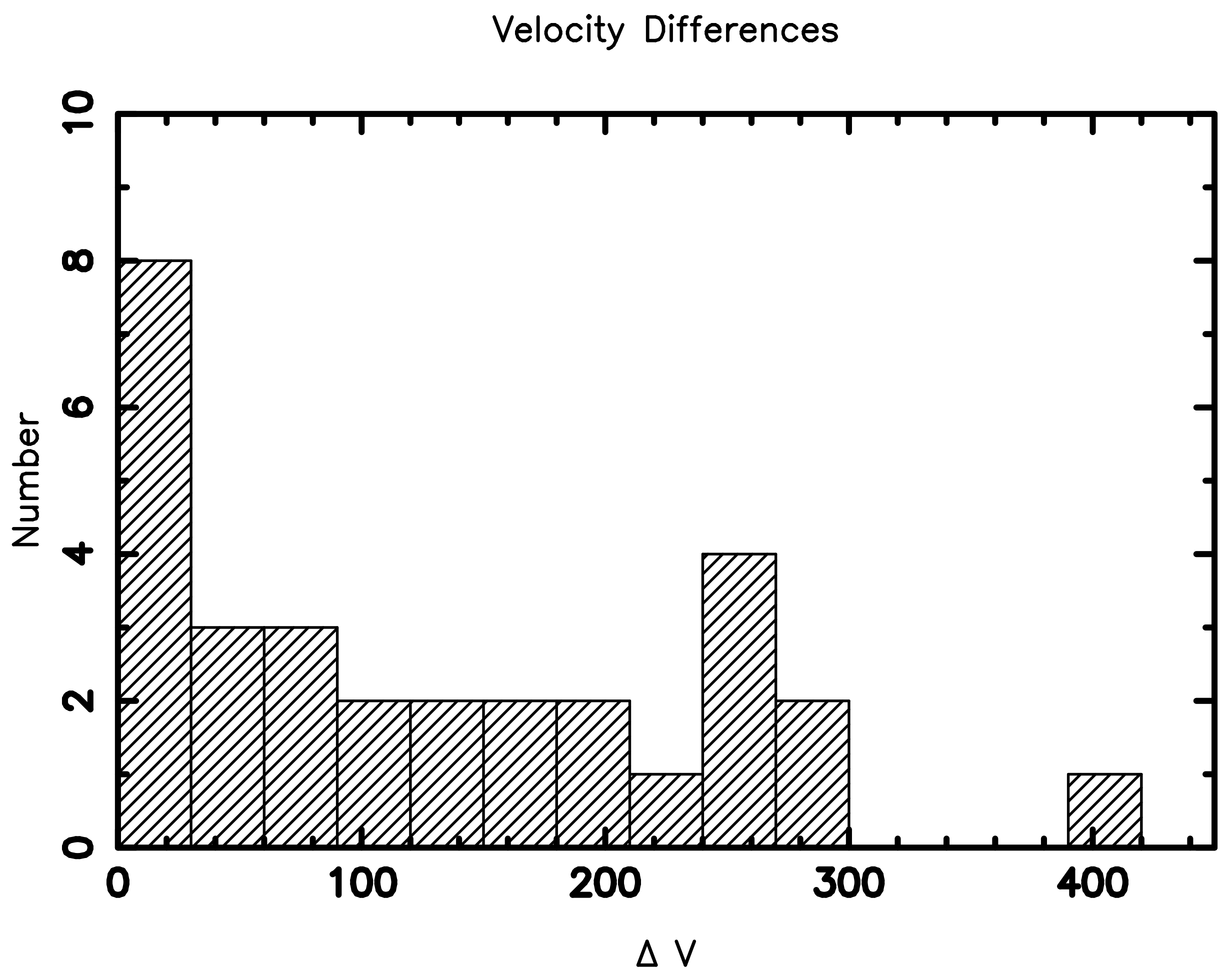
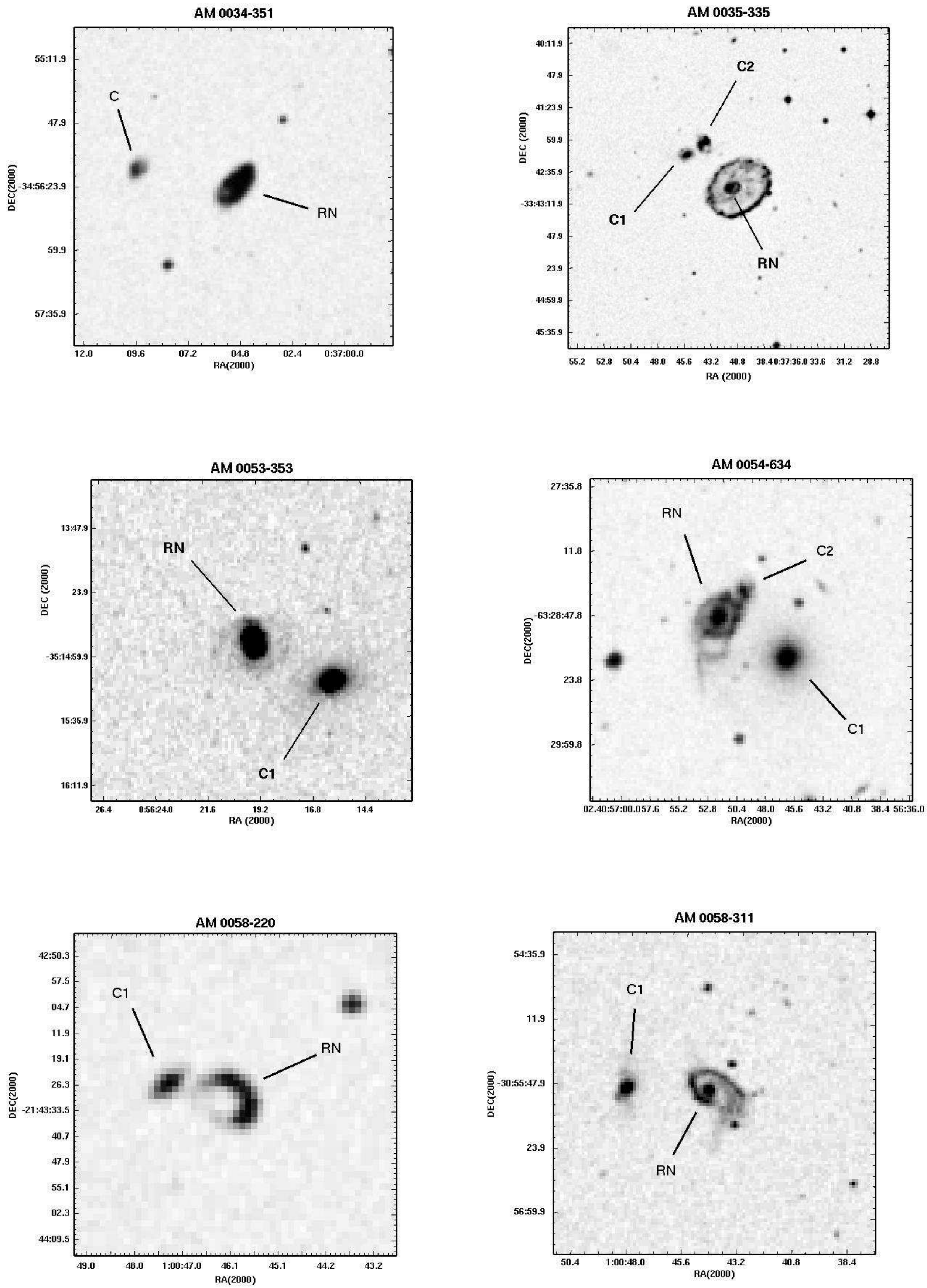


Fig. 4.— Histogram of the velocity differences between the ring and its collider.


AM 0034-351
C
RN
DEC(2000)
RA(2000)
AM 0035-335
C2
C1
RN
DEC (2000)
RA (2000)
AM 0053-353
RN
C1
DEC (2000)
RA (2000)
AM 0054-634
RN
C2
C1
DEC(2000)
RA(2000)
AM 0058-220
C1
RN
DEC(2000)
RA(2000)
AM 0058-311
C1
RN
DEC(2000)
RA(2000)

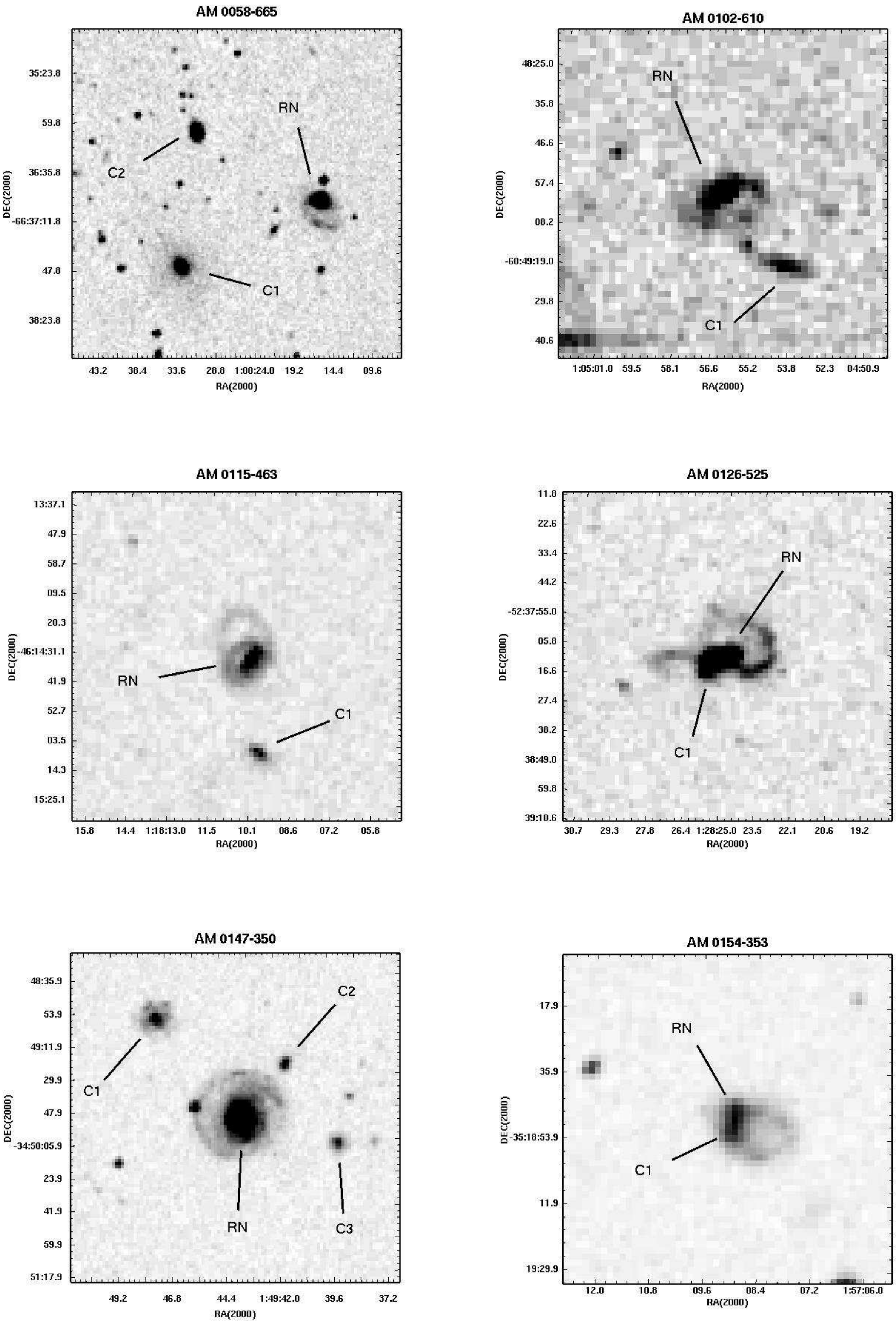

AM 0058-665
RN
C2
C1
AM 0102-610
RN
C1
AM 0115-463
RN
C1
AM 0126-525
RN
C1
AM 0147-350
C1
C2
RN
C3
AM 0154-353
RN
C1
DEC(2000)
RA(2000)

Table 1.

Host Ring System	Component Name	RA (2000) (h:m:s)	Dec (2000) (d:m:s)	D/S (arcsec)	$V_\odot$ (km/s)
AM 0034-351	AM 0034-351:RN	00:37:09.3	-34:56:15	D = 31	8,891
	AM 0034-351:C1	00:37:04.7	-34:56:24	S = 58	. . .
AM 0035-335	AM 0035-335:RN	00:37:41.1	-33:42:59	D = 58	9,050
	AM 0035-335:C1	00:37:44.7	-33:42:20	S = 61	9,104
	AM 0035-335:C2	00:37:43.1	-33:42:08	S = 60	8,639
AM 0053-353	AM 0053-353:RN	00:56:19.3	-35:14:53	D = 47	14,494
	AM 0053-353:C1	00:56:15.7	-35:15:15	S = 43	14,420
AM 0054-634	AM 0054-634:RN	00:56:51.1	-63:28:51	D = 27	11,557
	AM 0054-634:C1	00:56:45.5	-63:29:16	S = 20	11,526
	AM 0054-634:C2	00:56:48.8	-63:28:38	S = 45	. . .
AM 0058-220	AM 0058-220:RN	01:00:46.0	-21:43:30	D = 17	. . .
	AM 0058-220:C1	01:00:47.2	-21:43:26	S = 17	12,524
AM 0058-311	AM 0058-311:RN	01:00:44.5	-33:55:49	D = 34	23,650
	AM 0058-311:C1	01:00:48.1	-33:55:49	S = 46	23,684

Table 1—Continued

Host Ring System	Component Name	RA (2000) (h:m:s)	Dec (2000) (d:m:s)	D/S (arcsec)	$V_\odot$ (km/s)
AM 0058-665	AM 0058-665:RN	01:00:15.1	-66:37:07	D = 36	21,055
	AM 0058-665:C1	01:00:32.3	-66:37:49	S = 112	. . .
	AM 0058-665:C2	01:00:29.4	-66:36:11	S = 103	. . .
AM 0102-610	AM 0102-610:RN	01:04:56.3	-60:48:58	D = 22	. . .
	AM 0102-610:C1	01:04:53.8	-60:49:17	S = 26	. . .
AM 0115-463	AM 0115-463:RN	01:18:09.9	-46:14:32	D = 33	17,688
	AM 0115-463:C1	01:18:09.7	-46:15:07	S = 34	. . .
AM 0126-525	AM 0126-525:RN	01:28:24.6	-52:38:08	D = 29	3,700
	AM 0126-525:C1	01:28:25.2	-52:38:11	S = 06	3,450
AM 0147-350	AM 0147-350:RN	01:49:43.5	-34:49:53	D = 52	8,244
	AM 0147-350:C1	01:49:47.2	-34:48:57	S = 73	. . .
	AM 0147-350:C2	01:49:41.4	-34:49:25	S = 39	. . .
	AM 0147-350:C3	01:49:39.2	-34:50:08	S = 55	bckgrnd
AM 0154-353	AM 0154-353:RN	01:57:08.8	-35:18:47	D = 23	. . .
	AM 0154-353:C1	01:57:08.9	-35:18:51	S = 06	. . .

Table 1—Continued

Host Ring System	Component Name	RA (2000) (h:m:s)	Dec (2000) (d:m:s)	D/S (arcsec)	$V_\odot$ (km/s)
AM 0155-815	AM 0155-815:RN	01:54:41.4	-81:37:53	D = 38	. . .
	AM 0155-815:C1	01:53:00.8	-81:37:57	S = 43	. . .
	AM 0155-815:C2	01:52:39.7	-81:37:50	S = 05	. . .
AM 0157-311	AM 0157-311:RN	01:59:39.5	-31:01:11	D = 29	17,742
	AM 0157-311:C1	01:59:37.8	-31:01:22	S = 24	. . .
AM 0200-581	AM 0200-581:RN	02:01:50.8	-57:56:52	D = 27	. . .
	AM 0200-581:C1	02:01:50.7	-57:57:01	S = 10	. . .
	AM 0200-581:C2	02:01:51.4	-57:56:56	S = 06	. . .
AM 0240-242	AM 0240-242:RN	02:42:32.0	-24:13:52	D = 26	25,310
	AM 0240-242:C1	02:42:32.0	-24:13:57	S = 05	. . .
	AM 0240-242:C2	02:42:33.4	-24:13:05	S = 46	. . .
AM 0305-824	AM 0305-824:RN	03:01:44.3	-82:35:30	D = 34	. . .
	AM 0305-824:C1	03:02:01.8	-82:35:26	S = 34	. . .
AM 0318-610	AM 0318-610:RN	03:19:37.5	-60:57:01	D = 17	. . .
	AM 0318-610:C1	03:19:37.9	-60:57:10	S = 09	. . .

Table 1—Continued

Host Ring System	Component Name	RA (2000) (h:m:s)	Dec (2000) (d:m:s)	D/S (arcsec)	$V_\odot$ (km/s)
AM 0322-374	AM 0322-374:RN	03:23:54.6	-37:30:36	D = 43	1,405
	AM 0322-374:C1	03:23:53.7	-37:30:47	S = 15	1,397
AM 0339-625	AM 0339-625:RN	03:40:37.8	-62:46:49	D = 30/62	14,860
	AM 0339-625:C1	03:40:39.6	-62:46:36	S = 18	. . .
AM 0401-641	AM 0401-641:RN	04:01:36.9	-64:04:03	D = 40	. . .
	AM 0401-641:C1	04:01:43.4	-64:05:29	S = 16	. . .
	AM 0401-641:C2	04:01:54.9	-64:06:10	S = 85	12,457
	AM 0401-641:C3	04:01:37.2	-64:04:38	S = 78	. . .
	AM 0401-641:C4	04:01:46.7	-64:05:54	S = 28	. . .
AM 0403-555	AM 0403-555:RN	04:04:16.4	-55:46:23	D = 40	. . .
	AM 0403-555:C1	04:04:17.0	-55:46:06	S = 18	17,825
	AM 0403-555:C2	04:04:12.1	-55:45:20	S = 80	. . .
AM 0404-271	AM 0404-271:RN	04:06:28.8	-27:09:21	D = 25	26,443
	AM 0404-271:C1	04:06:29.4	-27:09:24	S = 08	. . .

Table 1—Continued

Host Ring System	Component Name	RA (2000) (h:m:s)	Dec (2000) (d:m:s)	D/S (arcsec)	$V_\odot$ (km/s)
AM 0413-590	AM 0413-590:RN	04:14:25.9	-58:57:45	D = 43	17,143
	AM 0413-590:C1	04:14:27.0	-58:57:40	S = 09	. . .
AM 0415-475	AM 0415-475:RN	04:16:29.9	-47:50:54	D gt 84	10,079
	AM 0415-475:C1	04:16:18.6	-47:49:12	S = 152	. . .
	AM 0415-475:C2	04:16:31.6	-47:50:43	S = 23	. . .
AM 0417-391	AM 0417-391:RN	04:19:39.6	-39:10:31	D = 31	15,255
	AM 0417-391:C1	04:19:38.9	-39:10:26	S = 09	. . .
	AM 0417-391:C2	04:19:39.9	-39:10:23	S = 10	15,255
	AM 0417-391:C3	04:19:40.5	-39:08:40	S = 114	14,820
	AM 0417-391:C4	04:19:40.4	-39:11:39	S = 70	. . .
	AM 0417-391:C5	04:19:51.3	-39:10:05	S = 140	15,185
AM 0425-421	AM 0425-421:RN	04:26:36.6	-42:05:38	D = 55	4,491
	AM 0425-421:C1	04:26:44.6	-42:05:42	S = 91	. . .
AM 0437-314	AM 0437-314:RN	04:39:40.0	-31:42:39	D = 28	. . .
	AM 0437-314:C1	04:39:40.3	-31:42:38	S = 05	. . .

Table 1—Continued

Host Ring System	Component Name	RA (2000) (h:m:s)	Dec (2000) (d:m:s)	D/S (arcsec)	$V_\odot$ (km/s)
AM 0437-644	AM 0437-644:RN	04:37:54.9	-64:38:59	D = 14	. . .
	AM 0437-644:C1	04:37:56.9	-64:39:06	S = 33	. . .
AM 0438-503	AM 0438-503:RN	04:39:20.5	-50:31:50	D = 38	. . .
	AM 0438-503:C1	04:39:22.1	-50:31:45	S = 15	. . .
AM 0438-661	AM 0438-661:RN	04:38:37.1	-66:13:03	D = 34	14,650
	AM 0438-661:C1	04:38:37.9	-66:13:49	D = 12	. . .
AM 0455-465	AM 0455-465:RN	04:57:01.7	-46:45:00	D = 15	. . .
	AM 0455-465:C1	04:57:04.1	-46:44:54	S = 26	. . .
	AM 0455-465:C2	04:57:06.5	-46:45:03	S = 49	. . .
	AM 0455-465:C3	04:57:00.1	-46:46:00	S = 60	. . .
	AM 0455-465:C4	04:56:55.8	-46:44:10	S = 83	. . .
	AM 0455-465:C5	04:57:06.5	-46:46:08	S = 80	. . .
AM 0507-512	AM 0507-512:RN	05:08:28.0	-51:21:29	D = 34	. . .
	AM 0507-512:C1	05:08:27.6	-51:20:38	S = 43	. . .
	AM 0507-512:C2	05:08:27.3	-51:21:22	S = 11	. . .
	AM 0507-512:C3	05:08:29.5	-51:21:42	S = 20	. . .

Table 1—Continued

Host Ring System	Component Name	RA (2000) (h:m:s)	Dec (2000) (d:m:s)	D/S (arcsec)	$V_\odot$ (km/s)
AM 0520-390	AM 0520-390:RN	05:22:42.5	-39:03:48	D = 43	15,114
	AM 0520-390:C1	05:22:43.4	-39:03:25	S = 26	. . .
	AM 0520-390:C2	05:22:48.3	-39:03:38	S = 68	. . .
	AM 0520-390:C3	05:22:44.3	-39:03:41	S = 23	. . .
AM 0521-434	AM 0521-434:RN	05:22:30.5	-43:46:17	D = 30	24,291
	AM 0521-434:C1	05:22:30.4	-43:45:51	S = 26	. . .
AM 0545-355	AM 0545-355:RN	05:47:22.0	-35:49:29	D = 42	13,885
	AM 0545-355:C1	05:47:19.4	-35:49:45	S = 36	. . .
AM 0545-434	AM 0545-434:RN	05:47:00.0	-43:44:56	D = 38	. . .
	AM 0545-434:C1	05:47:01.2	-43:44:33	S = 26	. . .
AM 0642-645	AM 0642-645:RN	06:42:34.2	-64:58:28	D = 20	. . .
	AM 0642-645:C1	06:42:32.7	-64:59:24	S = 05	. . .
	AM 0642-645:C2	06:42:33.4	-64:59:28	S = 05	. . .

Table 1—Continued

Host Ring System	Component Name	RA (2000) (h:m:s)	Dec (2000) (d:m:s)	D/S (arcsec)	$V_{\odot}$ (km/s)
AM 0642-801	AM 0642-801:RN	06:38:38.4	-80:14:50	D = 67	4,777
	AM 0642-801:C1	06:38:36.6	-80:14:49	S = 08	. . .
	AM 0642-801:C2	06:38:27.9	-80:14:59	S = 29	. . .
AM 0643-462	AM 0643-462:RN	06:45:03.3	-46:26:56	D = 60	12,056
	AM 0643-462:C1	06:45:00.2	-46:26:43	S = 36	. . .
AM 0644-741	AM 0644-741:RN	06:43:05.6	-74:14:12	D = 97	6,505
	AM 0644-741:C1	06:43:06.1	-74:12:55	S = 78	7,000
	AM 0644-741:C2	06:43:25.5	-74:15:27	S = 110	6,750
	AM 0644-741:C3	06:44:17.5	-74:16:37	S = 326	6,430
AM 0755-785	AM 0755-785:RN	07:53:31.5	-79:06:28	D = 27	. . .
	AM 0755-785:C1	07:53:35.6	-79:06:28	S = 13	. . .
AM 0814-760	AM 0814-760:RN	08:13:31.6	-76:17:29	D = 28	. . .
	AM 0814-760:C1	08:13:30.9	-76:17:41	S = 13	. . .

Table 1—Continued

Host Ring System	Component Name	RA (2000) (h:m:s)	Dec (2000) (d:m:s)	D/S (arcsec)	$V_\odot$ (km/s)
AM 1003-215	AM 1003-215:RN	10:05:43.2	-22:05:43	D = 28	26,329
	AM 1003-215:C1	10:05:43.3	-22:05:53	S = 12	. . .
	AM 1003-215:C2	10:05:43.4	-22:05:03	S = 41	. . .
	AM 1003-215:C3	10:05:44.1	-22:06:19	S = 38	. . .
	AM 1003-215:C4	10:05:46.2	-22:05:52	S = 43	. . .
AM 1006-380	AM 1006-380:RN	10:09:05.2	-38:24:35	D = 80	4,943
	AM 1006-380:C1	10:09:08.0	-38:23:48	S = 58	4,481
AM 1025-370	AM 1025-370:RN	10:27:13.8	-37:25:17	D = 27	. . .
	AM 1025-370:C1	10:27:13.8	-37:25:33	S = 16	. . .
AM 1133-245	AM 1133-245:RN	11:35:30.8	-25:08:44	D = 67	11,704
	AM 1133-245:C1	11:35:17.6	-25:08:45	S = 180	11,682
	AM 1133-245:C2	11:35:34.5	-25:05:41	S = 189	11,601
AM 1135-284	AM 1135-284:RN	11:37:42.2	-29:05:01	D = 24	5,558
	AM 1135-284:C1	11:37:36.2	-29:04:11	S = 97	. . .

Table 1—Continued

Host Ring System	Component Name	RA (2000) (h:m:s)	Dec (2000) (d:m:s)	D/S (arcsec)	$V_\odot$ (km/s)
AM 1152-421	AM 1152-241:RN	11:55:21.7	-42:29:19	D = 46	4,617
	AM 1152-241:C1	11:55:21.3	-42:29:17	S = 07	. . .
AM 1159-530	AM 1159-530:RN	12:01:35.9	-53:21:28	D = 55	. . .
	AM 1159-530:C1	12:01:32.3	-53:20:47	S = 52	. . .
AM 1249-462	AM 1249-462:RN	12:52:38.7	-46:38:59	D = 50	. . .
	AM 1249-462:C1	12:52:34.9	-46:40:04	S = 78	. . .
AM 1251-283	AM 1251-283:RN	12:54:42.4	-28:51:57	D = 29	17,003
	AM 1251-283:C1	12:54:43.1	-28:52:17	S = 24	16,242
	AM 1251-283:C2	12:54:43.1	-28:50:17	S = 100	16,359
	AM 1251-283:C3	12:54:36.5	-28:51:28	S = 82	bckgrnd
	AM 1251-283:C4	12:54:40.9	-28:53:03	S = 69	16,576
	AM 1251-283:C5	12:54:49.7	-28:52:37	S = 105	foregrnd
AM 1300-412	AM 1300-412:RN	13:03:00.3	-41:42:16	D = 18	3,422
	AM 1300-412:C1	13:03:00.4	-41:42:20	S = 05	. . .

Table 1—Continued

Host Ring System	Component Name	RA (2000) (h:m:s)	Dec (2000) (d:m:s)	D/S (arcsec)	$V_\odot$ (km/s)
AM 1308-253	AM 1308-253:RN	13:11:08.7	-25:54:00	D = 44	13,556
	AM 1308-253:C1	13:11:08.5	-25:54:00	S = 05	. . .
	AM 1308-253:C2	13:11:07.4	-25:54:28	S = 85	. . .
AM 1323-222	AM 1323-222:RN	13:26:20.3	-22:37:54	D = 88	4,627
	AM 1323-222:C1	13:26:29.4	-22:33:49	S = 272	bckgrnd
AM 1325-251	AM 1325-251:RN	13:27:58.1	-25:31:49	D = 18	10,936
	AM 1325-251:C1	13:27:57.7	-25:31:44	S = 07	. . .
	AM 1325-251:C2	13:27:57.1	-25:30:50	S = 52	. . .
AM 1354-250	AM 1354-250:RN	13:57:13.7	-25:14:44	D = 53	6,150
	AM 1354-250:C1	13:57:17.8	-25:13:30	S = 97	6,175
	AM 1354-250:C2	13:57:24.6	-25:13:59	S = 157	. . .
AM 1358-221	AM 1358-221:RN	14:01:08.0	-22:33:35	D = 53	10,940
	AM 1358-221:C1	14:01:13.2	-22:32:45	S = 87	. . .
	AM 1358-221:C2	14:01:12.8	-22:31:52	S = 121	. . .
	AM 1358-221:C3	14:01:25.6	-22:34:20	S = 247	10,786

Table 1—Continued

Host Ring System	Component Name	RA (2000) (h:m:s)	Dec (2000) (d:m:s)	D/S (arcsec)	$V_\odot$ (km/s)
AM 1413-243	AM 1413-243:RN	14:16:09.3	-24:50:30	D = 35	13,740
	AM 1413-243:C1	14:16:04.9	-24:49:21	S = 94	. . .
	AM 1413-243:C2	14:16:09.3	-24:51:09	S = 37	. . .
	AM 1413-243:C3	14:16:13.3	-24:50:47	S = 56	. . .
AM 1425-234	AM 1425-234:RN	14:55:09.8	-23:58:09	D = 61	. . .
	AM 1425-234:C1	14:55:09.4	-23:58:16	S = 09	. . .
	AM 1425-234:C2	14:55:08.0	-23:56:24	S = 112	. . .
	AM 1425-234:C3	14:55:00.6	-23:55:44	S = 195	. . .
AM 1434-783	AM 1434-783:RN	14:40:27.5	-78:48:35	D = 40	4,625
	AM 1434-783:C1	14:40:32.2	-78:48:28	S = 40	. . .
AM 1452-234	AM 1452-234:RN	14:55:09.8	-23:58:09	D = 61	12,304
	AM 1452-234:C1	14:55:09.4	-23:58:16	S = 09	. . .
	AM 1452-234:C2	14:55:08.0	-23:56:24	S = 112	. . .
	AM 1452-234:C3	14:55:00.6	-23:55:44	S = 195	. . .
AM 1514-362	AM 1514-362:RN	15:17:48.2	-36:34:56	D = 24	. . .
	AM 1514-362:C1	15:17:47.8	-36:35:00	S = 06	7,108

Table 1—Continued

Host Ring System	Component Name	RA (2000) (h:m:s)	Dec (2000) (d:m:s)	D/S (arcsec)	$V_{\odot}$ (km/s)
AM 1627-824	AM 1627-824:RN	16:35:56.7	-82:50:17	D = 32	. . .
	AM 1627-824:C1	16:36:01.0	-82:50:12	S = 11	. . .
	AM 1627-824:C2	16:35:17.2	-82:51:17	S = 94	. . .
AM 1724-622	AM 1724-622:RN	17:29:09.6	-62:26:45	D = 125	4,641
	AM 1724-622:C1	17:29:25.3	-62:28:50	S = 167	4,800
AM 1827-625	AM 1827-625:RN	18:32:02.7	-62:55:44	D = 33	4,086
	AM 1827-625:C1	18:32:02.6	-62:55:47	S = 04	. . .
AM 1854-490	AM 1854-490:RN	18:58:06.8	-49:00:41	D = 14	4,250
	AM 1854-490:C1	18:58:05.5	-49:00:52	S = 18	. . .
AM 1947-445	AM 1947-445:RN	19:51:19.8	-44:52:40	D = 62	5,805
	AM 1947-445:C1	19:51:26.3	-44:52:36	S = 141	5,672
AM 1953-260	AM 1953-260:RN	19:56:28.4	-25:54:56	D = 40	. . .
	AM 1953-260:C1	19:56:29.0	-25:55:16	S = 24	14,802

Table 1—Continued

Host Ring System	Component Name	RA (2000) (h:m:s)	Dec (2000) (d:m:s)	D/S (arcsec)	$V_\odot$ (km/s)
AM 1957-394	AM 1957-394:RN	20:00:36.0	-39:39:02	D = 51	. . .
	AM 1957-394:C1	20:00:35.4	-39:39:02	S = 05	. . .
AM 2012-282	AM 2012-282:RN	20:15:13.9	-28:18:25	D = 25	7,051
	AM 2012-282:C1	20:15:13.6	-28:18:24	S = 06	. . .
	AM 2012-282:C2	20:15:14.2	-28:18:19	S = 08	. . .
AM 2021-724	AM 2021-724:RN	20:26:29.2	-72:36:46	D = 28	. . .
	AM 2021-724:C1	20:26:33.7	-72:36:08	S = 42	22,706
AM 2024-544	AM 2024-544:RN	20:27:53.9	-54:38:00	D = 61	8,100
	AM 2024-544:C1	20:27:57.0	-54:37:51	S = 28	. . .
	AM 2024-544:C2	20:27:48.5	-54:38:28	S = 55	. . .
AM 2026-424	AM 2026-424:RN	20:29:32.2	-42:30:24	D = 61	. . .
	AM 2026-424:C1	20:29:33.5	-42:30:24	S = 17	15,486
AM 2033-260	AM 2033-260:RN	20:36:20.5	-25:56:52	D = 23	12,500
	AM 2033-260:C1	20:36:23.9	-25:57:29	S = 60	12,257
	AM 2033-260:C2	20:36:20.7	-25:56:41	S = 10	. . .

Table 1—Continued

Host Ring System	Component Name	RA (2000) (h:m:s)	Dec (2000) (d:m:s)	D/S (arcsec)	$V_{\odot}$ (km/s)
AM 2034-483	AM 2034-483:RN	20:38:08.7	-48:23:16	D = 22	. . .
	AM 2034-483:C1	20:38:06.2	-48:23:16	S = 26	. . .
	AM 2034-483:C2	20:38:02.8	-48:22:55	S = 63	. . .
AM 2044-691	AM 2044-691:RN	20:48:56.8	-69:05:32	D = 42	11,413
	AM 2044-691:C1	20:48:56.6	-69:05:29	S = 03	. . .
AM 2056-392	AM 2056-392:RN	21:00:07.3	-39:17:57	D = 48	. . .
	AM 2056-392:C1	21:00:15.8	-39:20:05	S = 150	. . .
AM 2100-725	AM 2056-392:RN	21:05:38.2	-72:47:09	D = 27	. . .
	AM 2056-392:C1	21:05:54.5	-72:47:20	S = 72	20,984
	AM 2056-392:C2	21:05:52.9	-72:47:22	S = 65	. . .
	AM 2056-392:C3	21:05:49.5	-72:46:21	S = 69	. . .
	AM 2056-392:C4	21:05:58.8	-72:47:59	S = 103	. . .
	AM 2056-392:C5	21:05:16.2	-72:47:58	S = 109	. . .
	AM 2056-392:C6	21:05:11.5	-72:47:04	S = 119	. . .
	AM 2056-392:C7	21:05:48.2	-72:47:29	S = 48	. . .

Table 1—Continued

Host Ring System	Component Name	RA (2000) (h:m:s)	Dec (2000) (d:m:s)	D/S (arcsec)	$V_{\odot}$ (km/s)
AM 2107-474	AM 2107-472:RN	21:10:31.0	-47:30:32	D = 31	5,060
	AM 2107-472:C1	21:10:31.4	-47:30:36	S = 05	. . .
AM 2128-302	AM 2128-302:RN	21:31:08.2	-30:16:27	D = 84	10,037
	AM 2128-302:C1	21:31:01.5	-30:19:40	S = 208	9,199
AM 2131-254	AM 2131-254:RN	21:34:29.2	-25:28:38	D = 33	16,218
	AM 2131-254:C1	21:34:31.1	-25:28:46	S = 29	. . .
AM 2131-495	AM 2131-495:RN	21:34:37.6	-49:42:46	D = 27	21,645
	AM 2131-495:C1	21:34:37.2	-49:42:32	S = 15	. . .
AM 2132-535	AM 2132-535:RN	21:36:11.1	-53:41:26	D = 32	. . .
	AM 2132-535:C1	21:36:13.0	-53:42:54	S = 91	. . .
	AM 2132-535:C2	21:36:27.1	-53:43:09	S = 176	. . .
	AM 2132-535:C3	21:36:26.7	-53:43:31	S = 188	. . .
AM 2134-471	AM 2134-471:RN	21:37:28.0	-47:02:09	D = 52	9,254
	AM 2134-471:C1	21:37:31.1	-47:00:38	S = 98	. . .
	AM 2134-471:C2	21:37:35.9	-47:02:40	S = 90	. . .

Table 1—Continued

Host Ring System	Component Name	RA (2000) (h:m:s)	Dec (2000) (d:m:s)	D/S (arcsec)	$V_\odot$ (km/s)
AM 2136-492	AM 2136-492:RN	21:39:25.6	-49:09:36	D = 40/72	15,990
	AM 2136-492:C1	21:39:31.6	-49:08:11	S = 104	. . .
AM 2141-515	AM 2141-515:RN	21:45:15.1	-51:41:54	D = 33	. . .
	AM 2141-515:C1	21:45:14.9	-51:41:49	S = 05	. . .
AM 2145-543	AM 2145-543:RN	21:49:08.5	-54:18:14	D = 22	19,544
	AM 2145-543:C1	21:49:08.2	-54:17:53	S = 22	. . .
AM 2152-592	AM 2152-592:RN	21:56:19.4	-59:07:15	D = 15	22,351
	AM 2152-592:C1	21:56:17.5	-59:07:17	S = 15	. . .
	AM 2152-592:C2	21:56:20.8	-59:06:51	S = 27	. . .
AM 2155-263	AM 2155-263:RN	21:58:38.4	-26:22:41	D = 27	21,255
	AM 2155-263:C1	21:58:37.2	-26:22:25	S = 23	. . .

Table 1—Continued

Host Ring System	Component Name	RA (2000) (h:m:s)	Dec (2000) (d:m:s)	D/S (arcsec)	$V_{\odot}$ (km/s)
AM 2200-715	AM 2200-715:RN	22:04:57.5	-71:42:14	D = 32	. . .
	AM 2200-715:C1	22:04:22.4	-71:43:20	S = 177	9,350
	AM 2200-715:C2	22:04:12.7	-71:35:08	S = 478	. . .
	AM 2200-715:C3	22:04:47.8	-71:35:59	S = 379	. . .
	AM 2200-715:C4	22:05:51.5	-71:39:51	S = 288	. . .
	AM 2200-715:C5	22:06:23.9	-71:43:53	S = 418	. . .
	AM 2200-715:C6	22:05:39.0	-71:46:45	S = 330	. . .
AM 2201-230	AM 2201-230:RN	22:04:19.3	-22:47:33	D = 24	21,732
	AM 2201-230:C1	22:04:19.5	-22:47:48	S = 17	21,675
AM 2220-493	AM 2220-493:RN	22:23:13.4	-49:17:46	D = 32	. . .
	AM 2220-493:C1	22:23:12.7	-49:17:16	S = 31	17,947
AM 2230-481	AM 2230-481:RN	22:33:47.0	-48:01:30	D = 52	10,476
	AM 2230-481:C1	22:33:43.3	-48:01:31	S = 37	10,361
AM 2238-541	AM 2238-541:RN	22:41:55.1	-53:58:43	D = 32	. . .
	AM 2238-541:C1	22:41:57.5	-53:59:45	S = 67	. . .

Table 1—Continued

Host Ring System	Component Name	RA (2000) (h:m:s)	Dec (2000) (d:m:s)	D/S (arcsec)	$V_\odot$ (km/s)
AM 2240-304	AM 2240-304:RN	22:43:36.9	-30:28:50	D = 22	17,449
	AM 2240-304:C1	22:43:36.3	-30:28:55	S = 08	. . .
AM 2302-322	AM 2302-322:RN	23:05:39.9	-32:09:07	D = 25	18,137
	AM 2302-322:C1	23:05:41.9	-32:08:11	S = 66	18,077
	AM 2302-322:C2	23:05:43.9	-32:09:46	S = 59	bckgrnd
AM 2308-324	AM 2308-324:RN	23:11:17.3	-32:27:07	D = 33	11,327
	AM 2308-324:C1	23:11:16.9	-32:27:21	S = 15	. . .
AM 2313-261	AM 2313-261:RN	23:15:46.5	-25:54:20	D = 20	6,472
	AM 2313-261:C1	23:15:46.5	-25:54:28	S = 09	. . .
AM 2317-672	AM 2317-672:RN	23:20:09.7	-67:08:58	D = 32	. . .
	AM 2317-672:C1	23:20:11.2	-67:09:00	S = 10	. . .
	AM 2317-672:C2	23:20:11.6	-67:08:28	S = 33	. . .
AM 2322-671	AM 2322-671:RN	23:25:42.8	-67:03:29	D = 19	. . .
	AM 2322-671:C1	23:25:45.3	-67:03:33	S = 15	. . .

Table 1—Continued

Host Ring System	Component Name	RA (2000) (h:m:s)	Dec (2000) (d:m:s)	D/S (arcsec)	$V_\odot$ (km/s)
AM 2323-512	AM 2323-512:RN	23:26:31.8	-51:08:07	D = 21	. . .
	AM 2323-512:C1	23:26:31.2	-51:07:45	S = 23	. . .
AM 2338-312	AM 2338-312:RN	23:41:26.0	-31:03:22	D = 54	17,538
	AM 2338-312:C1	23:41:19.2	-31:03:01	S = 91	17,268
AM 2343-703	AM 2343-703:RN	23:46:39.3	-70:22:51	D = 44	. . .
	AM 2343-703:C1	23:46:38.5	-70:22:25	S = 27	. . .
AM 2353-291	AM 2353-291:RN	23:56:23.8	-29:01:25	D = 36	8,931
	AM 2353-291:C1	23:56:25.1	-29:01:24	S = 17	8,953

Table 2.

Host Ring System	Component Name	RA (2000) (h:m:s)	Dec (2000) (d:m:s)	D/S (arcsec)	$V_\odot$ (km/s)
ARP 146	ARP 146:RN	00:06:44.3	-06:38:08	D = 19	22,616
	ARP 146:C1	00:06:44.7	-06:38:13	D = 09	. . .
ARP 318	ARP 318:RN	02:09:24.4	-10:08:10	D = 40	4,073
	ARP 318:C1	02:09:20.7	-10:08:00	S = 55	3,864
	ARP 318:C2	02:09:38.3	-10:08:48	S = 208	3,851
	ARP 318:C3	02:09:42.7	-10:11:02	S = 319	3,934
ARP 010	ARP 010:RN	02:18:26.2	+05:39:14	D = 44	9,108
	ARP 010:C1	02:18:28.6	+05:40:08	S = 65	. . .
ARP 273	ARP 273:RN	02:21:28.6	+39:22:32	D = 100	7,563
	ARP 273:C1	02:21:32.7	+39:21:24	S = 82	7,335
ARP 145	ARP 145:RN	02:23:07.7	+41:21:11	D = 57	5,425
	ARP 145:C1	02:23:11.1	+41:22:04	S = 36	5,852
NGC 0985	NGC 0985:RN	02:34:37.6	-08:47:15	D = 36	13,168
	NGC 0985:C1	02:34:38.6	-08:48:03	S = 47	. . .

Table 2—Continued

Host Ring System	Component Name	RA (2000) (h:m:s)	Dec (2000) (d:m:s)	D/S (arcsec)	$V_\odot$ (km/s)
ARP 118	ARP 118:RN	02:55:12.0	-00:11:03	D = 30	8,648
	ARP 118:C1	02:55:09.5	-00:10:40	S = 45	8,459
	ARP 118:C2	02:55:06.5	-00:09:46	S = 114	8,417
ARP 147	ARP 147:RN	03:11:18.6	+01:18:51	D = 17	9,656
	ARP 147:C1	03:11:19.4	+01:18:48	S = 14	9,415
IC 1908	IC 1908:RN	03:15:05.4	-54:49:09	D = 30	8,234
	IC 1908:C1	03:15:05.7	-54:49:20	S = 13	. . .
ESO 200-IG 009	ESO 200-IG 009:RN	03:21:40.5	-51:39:31	D = 29	17,328
	ESO 200-IG 009:C1	03:21:41.0	-51:39:49	S = 21	20,980
	ESO 200-IG 009:C2	03:21:43.6	-51:39:42	S = 32	. . .
ARP 219	ARP 219:RN	03:39:53.2	-02:06:47	D = 46	10,488
	ARP 219:C1	03:39:54.8	-02:07:25	S = 44	. . .
ARP 141	ARP 141:RN	07:14:20.0	+73:28:25	D = 75	2,728
	ARP 141:C1	07:14:20.2	+73:28:51	S = 26	2,735

Table 2—Continued

Host Ring System	Component Name	RA (2000) (h:m:s)	Dec (2000) (d:m:s)	D/S (arcsec)	$V_\odot$ (km/s)
ARP 143	ARP 143:RN	07:46:55.0	+39:00:56	D = 87	4,257
	ARP 143:C1	07:46:52.9	+39:01:55	D = 65	4,048
	ARP 143:C2	07:46:55.5	+39:00:27	D = 30	4,002
NGC 2793	NGC 2793:RN	09:16:47.1	+34:25:56	D = 46	. . .
	NGC 2793:C1	09:16:47.2	+34:25:48	S = 11	1,687
	NGC 2793:C2	09:16:40.8	+34:26:52	S = 97	bckgrnd
	NGC 2793:C3	09:16:46.6	+34:26:14	S = 18	1,667
ARP 142	ARP 142:RN	09:37:44.1	+02:45:39	D = 53	7,225
	ARP 142:C1	09:37:45.0	+02:44:51	S = 52	6,806
	ARP 142:C2	09:37:41.2	+02:46:45	S = 81	. . .
IC 0614	IC 0614:RN	10:26:51.8	-03:27:53	D = 34	10,258
	IC 0614:C1	10:26:51.9	-03:27:39	S = 16	. . .
	IC 0614:C2	10:26:49.0	-03:29:19	S = 97	18,097
ARP 107	ARP 107:RN	10:52:14.8	+30:03:28	D = 55	10,372
	ARP 107:C1	10:52:18.4	+30:04:20	D = 70	10,665

Table 2—Continued

Host Ring System	Component Name	RA (2000) (h:m:s)	Dec (2000) (d:m:s)	D/S (arcsec)	$V_{\odot}$ (km/s)
ARP 148	ARP 148:RN	11:03:52.4	+40:50:54	D = 18	10,551
	ARP 148:C1	11:03:53.8	+40:51:00	S = 17	. . .
ARP 335	ARP 335:RN	11:04:23.5	+04:49:44	D = 130	7,738
	ARP 335:C1	11:04:23.5	+04:49:29	S = 15	7,763
	ARP 335:C2	11:04:16.5	+04:52:10	S = 180	7,647
VII Zw 466	VII Zw 466:RN	12:32:04.9	+66:24:13	D = 21	14,490
	VII Zw 466:C1	12:32:10.6	+66:24:19	S = 34	. . .
	VII Zw 466:C2	12:32:13.1	+66:23:59	S = 50	14,100
	VII Zw 466:C3	12:32:11.6	+66:23:21	S = 65	14,360
NGC 4774	NGC 4774:RN	12:53:06.4	+36:49:10	D = 23	8,373
	NGC 4774:C1	12:53:05.8	+36:49:34	S = 25	8,373
VV 256	VV 256:RN	14:00:54.4	+40:59:19	D = 64	3,738
	VV 256:C1	14:00:56.2	+41:00:22	S = 68	3,834
KIG 0686	KIG 0686:RN	15:32:56.9	+46:27:07	D = 11	. . .
	KIG 0686:C1	15:32:57.5	+46:27:14	S = 09	656

Table 2—Continued

Host Ring System	Component Name	RA (2000) (h:m:s)	Dec (2000) (d:m:s)	D/S (arcsec)	$V_{\odot}$ (km/s)
KIG 0700	KIG 0700:RN	15:45:14.8	+00:46:24	D = 19	. . .
	KIG 0700:C1	15:45:14.3	+00:46:21	S = 08	3,839
ARP 125	ARP 125:RN	16:38:13.9	+41:56:19	D = 45	8,572
	ARP 125:C1	16:38:13.6	+41:55:51	S = 31	8,404
ARP 150	ARP 150:RN	23:19:30.0	+09:30:30	D = 34	11,879
	ARP 150:C1	23:19:31.0	+09:30:11	S = 26	11,562
	ARP 150:C2	23:19:33.7	+09:29:42	S = 75	11,637
	ARP 150:C3	23:19:27.7	+09:29:40	S = 59	12,350
ARP 284	ARP 284:RN	23:36:14.2	+02:09:17	D = 44	2,798
	ARP 284:C1	23:36:21.8	+02:09:25	S = 111	2,771